

INTRODUCTION

Downloading large files such as videos, game patches or even operating systems can be a slow and tedious business.

A relatively new type of download system makes downloading large files much more efficient. BitTorrent works by having lots of users store a popular large file on their computers. When you download a file from the system, you're downloading it from several sources at once. So downloads continue to work, even if some users log off, and download speeds are often quicker than normal.

BitTorrent software divides a file into many pieces, each of which can be downloaded independently of the others. As soon as you have a bit of a file, it is made available for other BitTorrent users to download. So once you start downloading a file, you are providing parts of that file to other users at the same time.

BitTorrent is the fastest and most reliable file-sharing technology that is currently available. We'll show you how to use it, and how to make it even faster.

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Quicker downloads with BitTorrent

BitTorrent isn't just another peer-to-peer program. It's far cleverer than that and, when used properly, it can slash your download times, as Peter Wood explains

No-one likes waiting, least of all for downloads to complete. Yet even with broadband, downloading large files can often be frustratingly slow. In this month's *Advanced Windows*, we show you how you can get the fastest download speeds possible using the BitTorrent file-sharing technology.

BitTorrent is a protocol for sharing files over a peer-to-peer network. It was created by the programmer Bram Cohen, who demonstrated it for the first time at the San Francisco CodeCon hacker conference in 2002. In the five years since it was first made available, BitTorrent has become hugely popular. According to a study by web analysts CacheLogic, BitTorrent accounted for up to 35 per cent of all internet traffic by 2004. The secret of BitTorrent's success is simple: it provides much faster downloads than competing technologies, it's easy to use, and it addresses several problems faced by other file-sharing systems.

BASIC PRINCIPLES

To share a file using BitTorrent, you must first create a torrent. A torrent is a small file, no more than a few kilobits in size, which describes the file you want to share. Most BitTorrent clients can be downloaded free of charge and have a function for making torrent files.

Anyone who wishes to download and share the file you are making available will first need to download a copy of the tiny torrent file. To make the torrent available to the public, you must associate it with a tracker. A tracker is a server that, as its name suggests, keeps track of all the computers that host a particular torrent. When you first create your torrent file, your BitTorrent software will prompt you to associate it with a tracker. Lists of live trackers can be found simply by typing "live bittorrent tracker" into Google.

Once you have created your torrent and associated it with a live tracker, you must upload it to a BitTorrent search website such as www.isohunt.com or www.thepiratebay.org. This makes the torrent available to anyone who enters the right search criteria into that

website. Uploading torrent files is easy and quick. Just follow the instructions on the site of your choice.

When the first user downloads your torrent, their BitTorrent software queries the tracker, asking it to find any currently online systems (known as peers) that are hosting the file associated with the torrent. Because no-one else should have the torrent or its associated file yet, and as long as your BitTorrent program is running, the tracker will tell the first downloader to download the file from you. At this point, BitTorrent works like a normal peer-to-peer file-sharing program, with one user downloading directly from another. But things change when more users decide to download your torrent.

When it shares a file, BitTorrent software chops up that file into pieces, each roughly 2,048 kilobits in size. Smaller files are chopped into smaller chunks. When you download a file, you can simultaneously download pieces of data from several other peers. As soon as a participating computer has downloaded a piece of a file, it will make that piece available for others to download. It does not need to have a complete copy of the file before it can start sharing. Soon there may be several peers, all hosting different bits of the file, swapping bits with each other. A group of BitTorrent peers sharing a file in this way is called a swarm. The sharing continues until all the members of the swarm have a complete copy of the file.

This is different to previous peer-to-peer file-sharing schemes, under which it was possible only to share complete files with one user at a time. Because it allows peers to download bits from several peers simultaneously, rather than one bit at a time from a single peer, BitTorrent is a lot faster than other types of file sharing.

When it divides a file into pieces, a BitTorrent client associates each piece with a hashing algorithm, a number that is recorded in the torrent file. There are two reasons for this. First, when a chunk is downloaded, the BitTorrent software checks the hashing algorithm in the torrent file against that of the chunk. If the two don't match, the piece of data has been corrupted and needs to be downloaded again. Second, when deciding in what order to download the bits of a file, the client queries all the computers it can find online that host part of that file in order to find out which pieces of the file each peer has. It then requests the most rare bits first. By downloading the less widely available parts of the file first, it insures against the eventuality that the few peers with copies of these pieces of data may go offline. It also helps to proliferate those pieces throughout the BitTorrent network, helping to make them less rare in the future.

SHARE TACTICS

Small children are enthusiastic about sharing, as long as it involves them being allowed to share someone else's things. Ask them to share their own precious possessions with someone else, and they become truculent and uncooperative. Sadly, many internet users



▲ Creator Bram Cohen's website is a useful source of BitTorrent information. As the technology is open source, anyone can develop and change it

HOW TO... Create a torrent

The first step in making a file available for other people to download is to create a torrent file. This describes the location of the file you want to share, along with other information that BitTorrent needs to download it. Creating this file is best done using the BitTorrent client software. To create a torrent, just follow the four simple steps in this walkthrough.

Once you have followed these steps and created your torrent, simply upload it to the

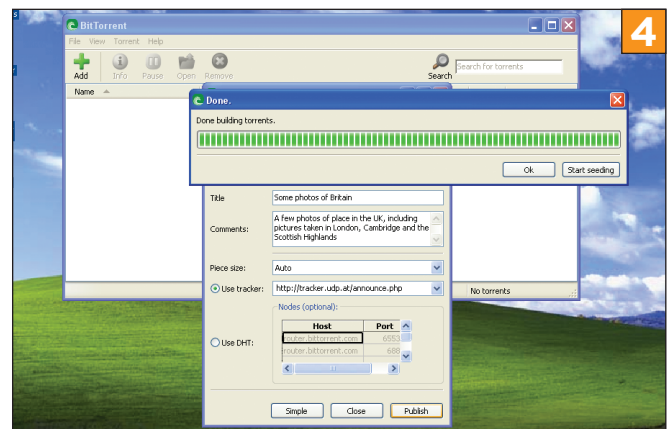
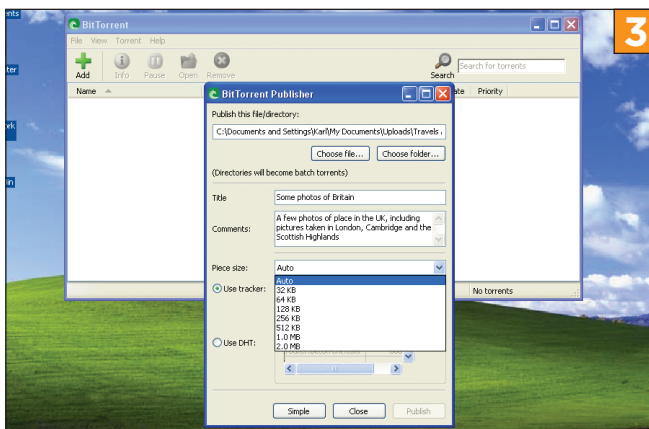
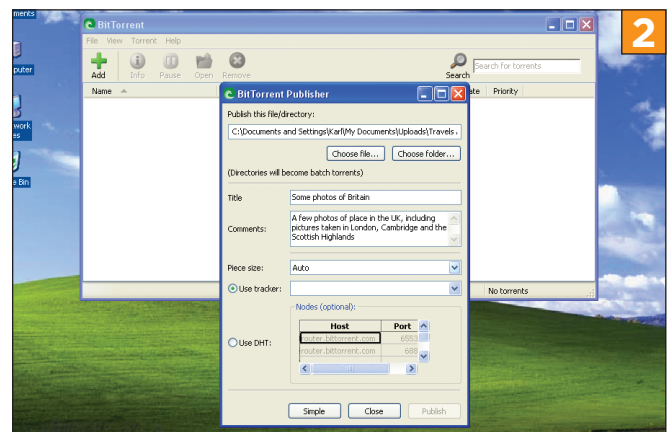
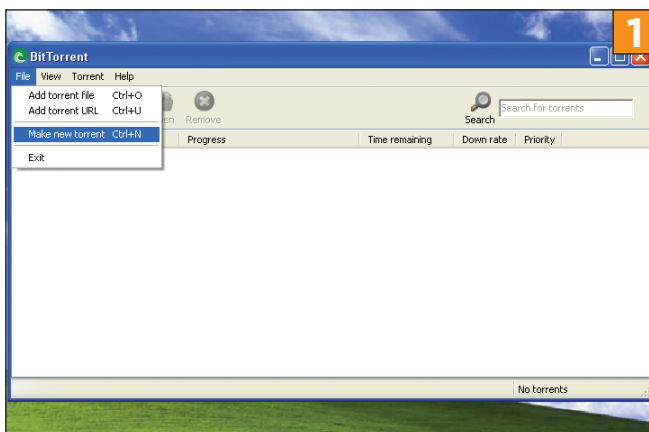
BitTorrent search site of your choice in order to make it available to others.

1 Open your BitTorrent program and pick Create Torrent, or a similar option. This can be found under the File menu.

2 In the Create Torrent dialog, pick the file you wish to create a torrent for, give the torrent a name and write a short description.

3 Some BitTorrent programs will allow you to choose the size of the pieces into which your file is split. For most people, the default setting of a quarter of a megabyte is fine.

4 Make sure that you have associated a tracker with your torrent and then press Publish. A list of live BitTorrent trackers can be found at <http://thebeehive.info>.



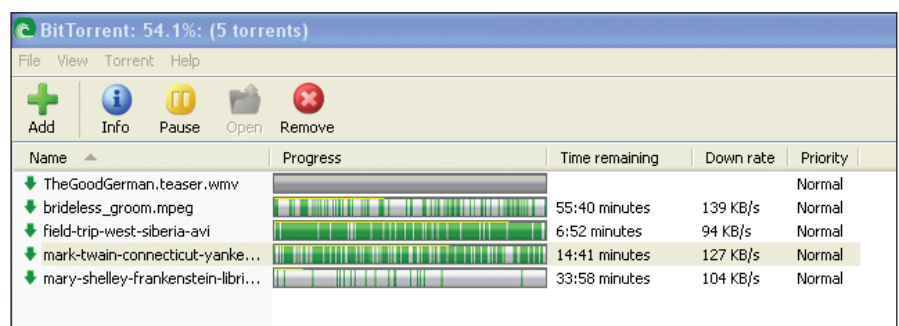
have a lot in common with toddlers. In previous peer-to-peer networks, a large minority of users would go out of their way to make it as difficult as possible for others to download files from them, while downloading as many files as possible from others. This behaviour is called leeching. It's anti-social, and BitTorrent includes features that penalise it.

BitTorrent clients upload files only to a certain number of peers for each torrent and at any one time. The criterion by which it chooses with whom to share is upload speed. When it receives download requests from other BitTorrent peers, it looks at the upload speed of each peer, which is the speed at which those peers offer files for other users to download. The program will share with those peers offering the fastest upload speeds. Of those peers, your program will offer the most bandwidth to those offering the most bandwidth in return. Even when it stops uploading to a peer, a situation known as 'choking', your BitTorrent program will

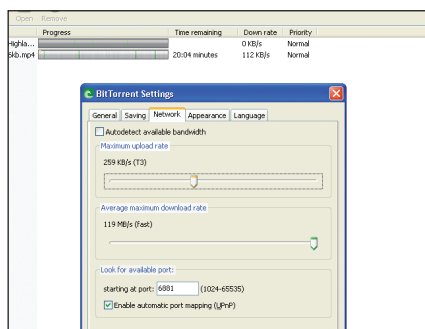
continue to download from that peer for as long as it can.

After receiving no data from you for about a minute, that peer assumes it has been choked and stops sharing. To make sure it's not missing out, BitTorrent software will try one new peer

about every 30 seconds if more peers have come online or an existing peer has increased its upload speed. This is called an 'optimistic unchoke'. This tit-for-tat system of allocating bandwidth rewards good behaviour (and those with the fastest broadband) with faster download speeds.



▲ Downloading with BitTorrent is easy. Just download your torrent, open your BitTorrent client, decide where you want to save your files, and you're off



▲ Set your BitTorrent upload speed to 80 per cent of your connection's maximum upload speed

So to recap, here is the main terminology you need to understand before using BitTorrent:

BITTORRENT JARGON

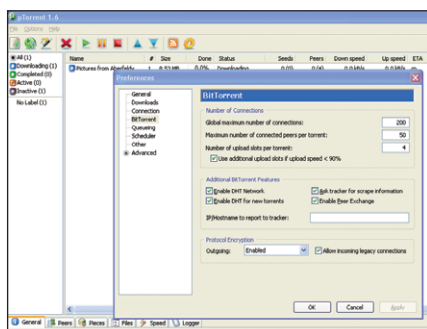
Leech	A user who downloads files but doesn't share them
Seed	A computer with a complete copy of a file
Swarm	A group of computers simultaneously exchanging bits of a file
Torrent	A small descriptor file that tells your PC from where it can download the file you want
Tracker	A server that keeps track of which users are sharing certain files

GETTING STARTED

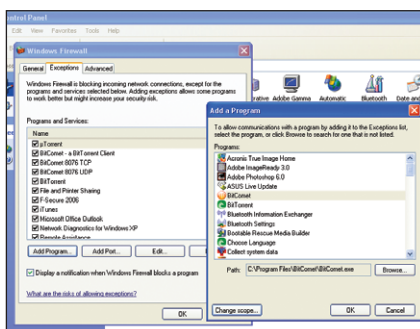
To run BitTorrent you first need to choose a BitTorrent client program. There are two we particularly like. The official BitTorrent client available from Bram Cohen's own site (www.bittorrent.com) is easy to use and has plenty of options. We also like the standalone version of µTorrent (www.utorrent.com) because it is easy to use and runs from an EXE file rather than requiring you to install it properly on your PC. As such, it causes minimum disruption to your system. Once you have your software running, you can start downloading.

We'll start by showing you how to upload. The file we have decided to use for our torrent is a Zip file containing photographs we've taken on excursions around Britain. Because we created these images, we're not breaching copyright by offering them for others to download. We've put the photos in a Zip folder because this allows us to offer them for download as a single file. If possible, however, it's often best to avoid using Zip files when creating torrents. Some users assume that a Zip is being used to hide a virus or other form of malware.

Downloading a torrent is just as easy. First, you need to find the file you want to download. If the file has an associated torrent, finding it should be no problem because there are lots of BitTorrent search sites. When you click to



▲ Some ISPs limit the bandwidth made available to BitTorrent users, so you must encrypt your traffic



▲ If you have XP Firewall, launch the firewall from the Control Panel then use the Add Program button

download the torrent, your BitTorrent software should open automatically. If it doesn't, start it running yourself and check under the File menu for an option called 'Add torrent' or similar.

When you open a torrent in your BitTorrent software, the program will ask where you want to save the torrent and the file associated with it. Decide where you want to save these files, and the software will download them for you. That's all there is to it. You don't have to sit by the PC because the program doesn't require attention.

Most BitTorrent clients can be shut down in the middle of a download. When you start it up, it will interrogate the tracker, find the relevant swarm and continue the download process.

MAKING BITTORRENT FASTER

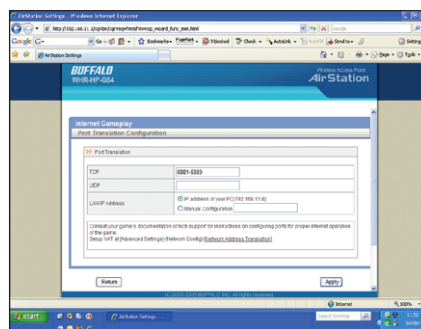
If you just install a BitTorrent program and do not optimise your system, your download speeds will not be as fast as they could be. There are several things you can do to improve the performance:

• Maximise your upload speed

The faster you upload to others, the faster they will allow you to download from them and the less likely they are to choke you out. Many programs allow you to specify the maximum upload rate and their default may be lower than the best rate your connection could provide. To get the best results, set your BitTorrent upload speed to about 80 per cent of your connection's maximum upload speed.

• Configure your firewall so that it works with BitTorrent

Your PC may block the TCP ports 6881-6889 that BitTorrent uses for incoming connections. If so, people won't be able to download from your system and your download speeds will suffer. You can either specify that the firewall unblock those ports or simply tell your firewall to treat your BitTorrent client as an exception, allowing it to send and receive packets over the internet freely. Users of the Windows XP Firewall can do this by launching the firewall from the Control Panel, then using the Add Program button on the Exceptions tab.



▲ Traffic may be blocked by your broadband router; you need to configure the router for port forwarding

• Configure your router for port forwarding

Even though you've told your PC's firewall to allow traffic on the necessary ports, they may still be blocked by your broadband router. To get around this, you must tell your router to send any traffic it receives on those ports to the PC or PCs on which you use BitTorrent. This is called port forwarding, although on some routers it may appear listed as port mapping for games, or something similar.

• Encrypt your BitTorrent traffic

Some ISPs don't like their customers using BitTorrent as it requires too much bandwidth and is often left running for long periods. They address this problem by limiting the bandwidth they make available to BitTorrent users. You can get around this by encrypting your traffic, making it more difficult for your ISP to recognise and throttle it. The official BitTorrent client does not provide encryption, but other clients do, including Azureus, Bitcomet and µTorrent.

KEEP IT LEGAL

There is nothing illegal about BitTorrent in itself. You break the law only when you use a BitTorrent client to download copyrighted material, or upload content for which you don't own the copyright. Many BitTorrent search engines offer copyrighted and non-copyrighted material for download without giving any guide as to which is which. It is up to you to make the distinction, although it is usually clear. If you use BitTorrent to break the law, you are liable for prosecution.

Legal warnings aside, BitTorrent is a great way to get faster downloads. There are lots of useful, fun and legal downloads available, and you can find plenty at www.bittorrent.com. Others can be found at www.legaltorrents.com.

Once you understand how BitTorrent works, and how to get the most from it, there's no reason not to give it a try. However, when downloading files from an unknown location, always make sure you have a working and up-to-date anti-virus program, and a good firewall that includes application control. The one that comes with Windows XP and Vista does not. **ES**

Hash incentive DHT and trackerless torrents

Although it's still usual for each torrent to be associated with a tracker, it's now possible to have trackerless torrents, too. This is useful because BitTorrent trackers sometimes have a short lifespan, possibly for legal reasons, and a normal torrent needs a tracker in order to be shared on the networks.

Trackerless torrents work using a technology called distributed hash tables (DHT). Trackerless torrents are more robust than normal torrents, but may be more difficult for BitTorrent software to discover. Most current BitTorrent programs support DHT torrents.